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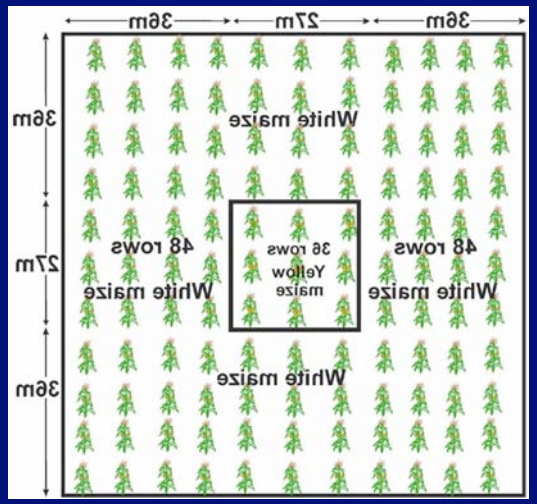
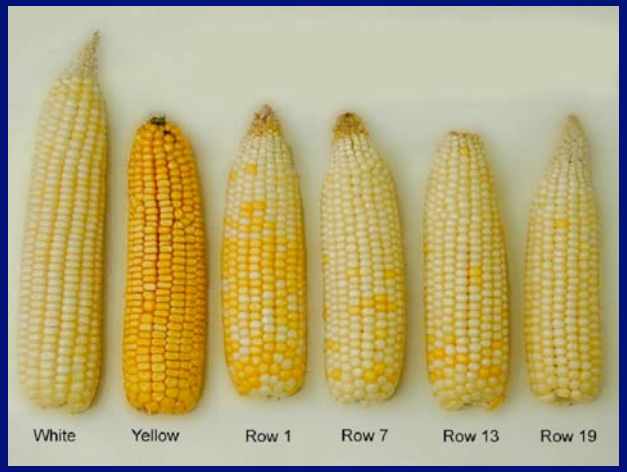
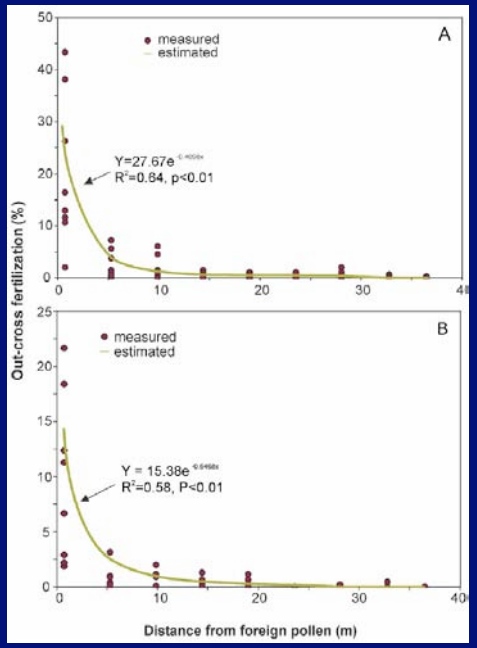
Pollen Drift of Corn







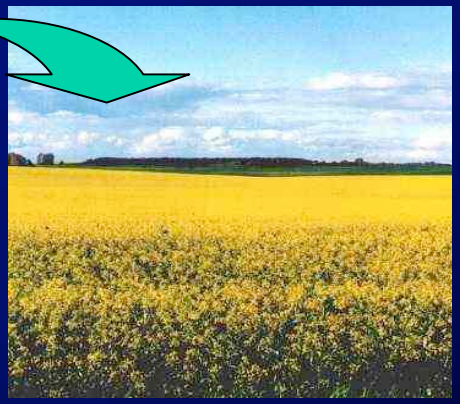
SOURCE: Ma, B.L. 2005. Frequency of Pollen Drift in Genetically Engineered Corn. ISB News Report, February 2005.

Pollen Flow Distances for Crop Species of Interest

Crop Type	Mode of Pollination	Means of Movement	Fdn Seed Prod Isolation Distance	Measure Pollen Movemnt Dstance
Alfalfa	Self-sterile; obligate outcrossing	Bees	900 ft (0.17 mi)	2000 ft (0.48 mi)
Bentgrass	Clonal (stolons); type outcrossing dep on environment	Wind	900 ft (98%purity) (0.17 mi)	13.05 mi
Canola	Predom. selfing; 30% outcrossing	Wind/insects	>1320 ft (0.25 mi)	1.9 mi
Corn	Almost exclusively outcrossing	Wind	660 ft (0.125 mi)	~2 mi
Cotton	Predom. Seslfing; outcrossing with insects	Insects	>1320 ft (0.25 mi)	n.a.
Rice	Self-pollinating (99.5%); pollen viable 3-15 min	Physical touching/wind	10 ft	30 ft
Squash	Obligate outcrossing	Insects (predom. bees)	1320 ft (0.25 mi)	0.8 mi
Soybean	Self-pollinating (99%)	Physical touching/wind	5 ft	n.a.
Wheat	Self-pollinating (99.9%)	Physical touching/wind	5 ft	>160 ft

Consequences of gene flow from GE crops to weedy species in field

GM canola



non-GM canola

Question – What Are the Consequences of Gene Flow? Consider Vitamin A Genes vs. Herbicide Tolerance Genes from GE Rice to Weedy Red Rice

Pollen Flow between Herbicide-Tolerant Canola: Cause of Multiple Resistant Canola Variety

crossing

"Triple-resistant canola"
(Two GE traits; one mutation)
Hall et al. (2000)

Consequences of Triple-Resistant Canola and HT-Wild Hybrids?

canola

What is the actual risk?

- HT doesn't necessarily translate into increase in weediness
- HT gene only helps plant if you spray target herbicide
- Eventually can't use specific herbicide

Who stands to lose?

- Herbicide manufacturer
- HT plant developer
- Farmer

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- Transfer of transgenes to organic crops?
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What Exactly Is Organic Agriculture? It is a production system that…

- Places a priority on health of crops, animals, farmers, environment, and consumers
- Doesn't use synthetic pesticides and fertilizers
- Focuses on improving soil fertility through use of organic matter and cover crops
- Supports and enhances an abundance of beneficial insects
- Must have 3 years with no prohibited material and be inspected on an annual basis by a USDA accredited certifier to be certified organic

P. Ronald UC Davis

US Organic Sales Figures

Total Foods and Organic Foods Consumer Sales and Market Penetration: 1997-2005				
	Organic Food ($mil)	Organic Food Growth	Total Food Sales ($mil)	Organic Penetration
1997	$ 3,594	n.a.	$443,790	0.81%
1998	$ 4,286	19.2%	$454,140	0.94%
1999	$ 5,039	17.6%	$474,790	1.06%
2000	$ 6,100	21.0%	$498,380	1.22%
2001	$ 7,360	20.7%	$521,830	1.41%
2002	$ 8,635	17.3%	$530,612	1.63%
2003	$10,381	20.2%	$535.406	1.94%
2004	$11,902	14.6%	$544,141	2.19%
2005	$13,831	16.2%	$556,791	2.48%

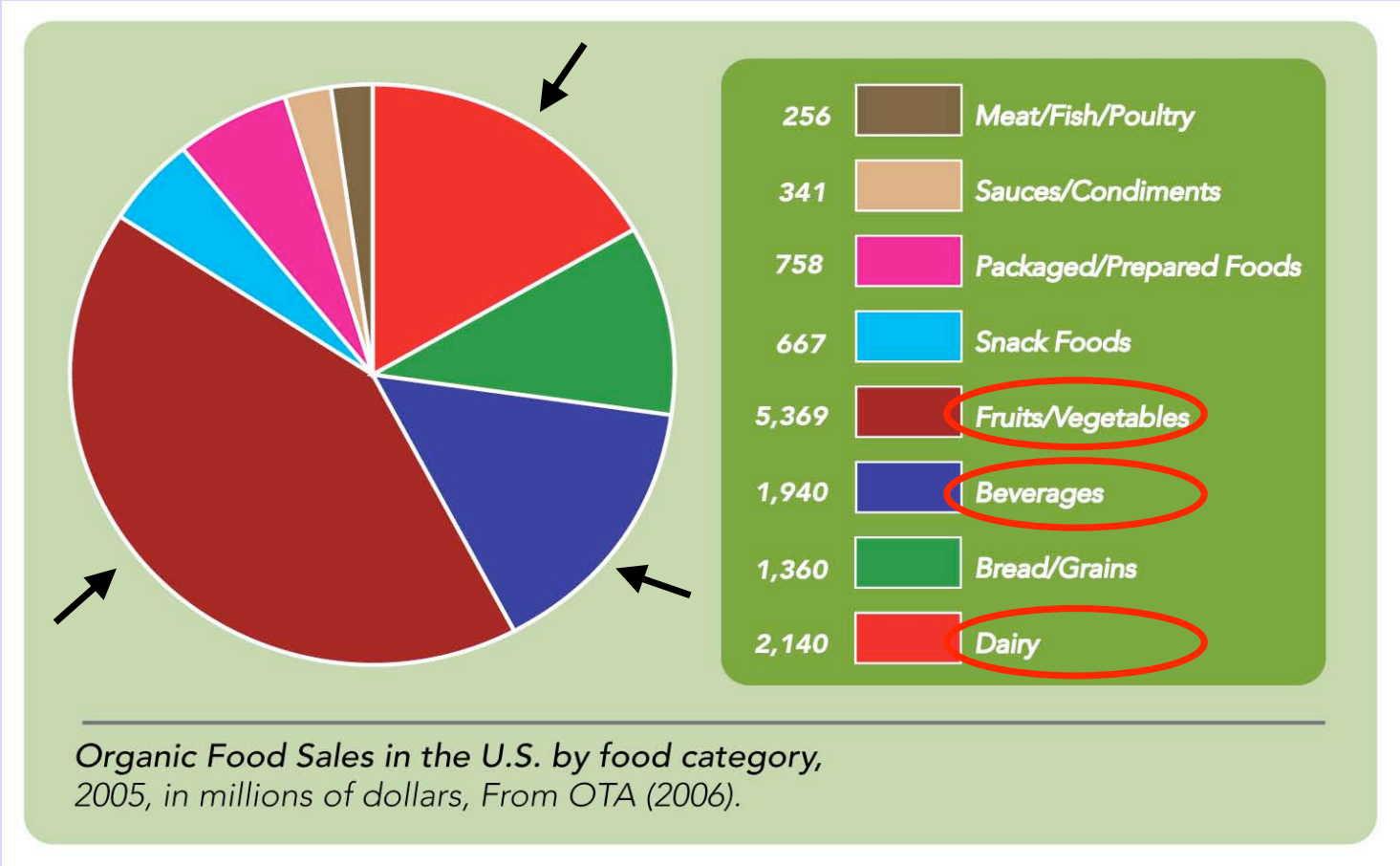
3-fold increase in market share since 1997 at a rate of growth of ~15-20%/year. This represents $13.8 billion

The % of total food market remains low at 2.5%

Source: Nutrition Business Journal estimates based on Organic Trade Association's 2006 marketing survey, annual Nutrition Business Journal marketing surveys and other sources (http://www.ota.com/pics/documents/short%20overview%20MMS.pdf)

Organic Food Sales in the U.S. by food category, 2005

(Source: Organic Trade Association, 2006)



Organic Food Sales in the U.S. by food category, 2005, in millions of dollars, From OTA (2006).

SOURCE: Winter, C.K. and Davis, S.F. 2007. Are organic foods healthier? CSA News 52: 2-13.

In 2001 organic acreage (cropland and pastureland) was 0.3% of U.S. agricultural acreage; >2% for some vegetables

(most recent figures: ers.usda.gov/publications/aib780a.pdf)

CA Organic Production Acreage

	Total acres 2004[1]	Organic acres 2004[2]	GE Acres 2004 estimates[3]
Alfalfa	130,000	4920 (~3.78%)	0 (not available)
Field Corn	540,000	383 (~0.07%)	300,000 (~57%)
Upland Cotton	560,000	273 (~0.01%)	260,000 (~54%)
Gross Value ($)	**$31.8 billion**	**$752 million (~ 2%)**	

[1] http://www.nass.usda.gov:8080/QuickStats/PullData_US
[2] http://www.cdfa.ca.gov/is/i&c/docs/2004CountyReport.pdf
[3] Martin Lemon, Monsanto, personal communication.

Organic Agriculture

Can It Coexist with GE Crops? How?

Capital Press, September 16, 2005

Communicate to avoid pesticide drift, winemaker says

Is this the first time coexistence between conventional and organic agriculture has been an issue?

By MATEUSZ PERKOWSKI
Freelance Writer

Fifteen years ago, David Adelsheim received some bad news. His vineyard manager had noticed was overgrown with blackberry bushes with a growth regulator herbicide containing 2,4-D. Aside from killing the blackberries, some of the herbicide had drifted onto the rows of grapevines growing only 15 feet away.

Roughly five acres were affected by the drift, which was about a third of Adelsheim Vineyards at the time. The first several rows were the most badly damaged, but even grapevines 30 rows down were showing some deformation. Because the neighbor had sprayed in mid-spring – after the grape bud break but prior to bloom – much of the year's crop had been aborted, and the remaining vines were too damaged to ripen any grapes.

In the decade and a half since then, Adelsheim Vineyards has managed to overcome the injury caused by the incident – the company has expanded to 180 acres, and the five acres ravaged by the herbicide have largely recovered. Nonetheless, Adelsheim said the effects of the

MATEUSZ PERKOWSKI/For the Capital Press

David Adelseheim examines some grapes at his vineyards near Newberg, Ore. Fifteen years ago, herbicide drift damaged several acres of his grapevines, and Adelsheim said the affected plants have never fully recovered.

One of the most divisive issues regarding genetic engineering is the suggestion that a choice must be made between EITHER "organic agriculture" OR "GMOs".

As long as these issues are polarized into "all is permitted" or "nothing is permitted", rational social discussion is impossible. Dualism (right versus wrong) is the enemy of compromise.

Co-existence

development of best management practices used to minimize adventitious presence of unwanted material and effectively enable different production systems to co-exist to ensure sustainability and viability of all production systems. General concept of co-existence is well established in California with conventional, organic and IPM systems working together.


Organic
TOWN & COUNTRY
Naked
Naked Juice
Certificate of Appreciation
Town & Country Market
How might a GE crop be a co-existence issue for an organic farmer?
ucbiotech.org

...What Genetic Modification Input Methods Are PERMITTED? (§ 205.2 National Organic Program)

- they "...include the use of traditional breeding, conjugation, fermentation, hybridization, in vitro fertilization, or tissue culture."

F.J. Chip Sundstrom CCI

…And What Genetic Modification Input Methods Are PROHIBITED?
(§ 205.2 National Organic Program)

- **"A variety of methods…are not considered compatible with organic production. Such methods include cell fusion, micro- and macro-encapsulation, & recombinant DNA technology (including gene deletion, gene doubling, introducing a foreign gene, & changing the positions of genes when achieved by recombinant DNA technology)."**

F.J. Chip Sundstrom CCL

Are There Tolerances for GE in Organic Products?

From NOP preamble…

- **Organic Production is a <u>PROCESS</u> certification NOT a <u>PRODUCT</u> certification – it allows for Adventitious Presence (AP) of certain excluded methods.**
  - **"As long as an organic operation has not <u>used</u> excluded methods and <u>takes reasonable steps</u> to avoid contact with the products of excluded methods …<u>unintentional presence of products of excluded methods should not affect status of an organic product or operation</u>."**

F.J. Chip Sundstrom CCIA

- **Pesticides: "When residue testing detects prohibited substances at levels that are greater than 5% of the EPA's tolerance for the specific pesticide residue detected…the agricultural product must not be sold or labeled, or represented as organically produced."**

- **GMOs: At the present time there are no specified tolerances for GMOs in organic products. Organic products are not 'guaranteed' GMO-free, although some organic farmers sign contracts guaranteeing GMO-free**

So, will an organic farmer automatically lose his accreditation if his/her crop is found contaminated with a GE crop?

No.

"As long as an organic operation has not used excluded methods and takes reasonable steps to avoid contact with the products of excluded methods, as detailed in their approved organic system plan, the unintentional presence of the products of excluded methods should not affect the status of an organic product or operation."

SOURCE: AMS National Organic Program Q&A

An organic farmer can lose the ability to sell a crop as organic if a contract is voluntarily signed stating the crop is 100% GE- free and evidence of GE contamination is found.

This is not an NOP organic rule but a private agreement.

SOURCE: AMS National Organic Program Q&A

ucbiotech.org

Where to get more information on the issues?